A FINANCIAL EVALUATION OF WHEAT PRODUCTION PROJECTS UNDER CENTER PIVOT IRRIGATION SYSTEMS IN ANBAR GOVERNORATE

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ABSTRACT

The research aims to identify the financial feasibility of cultivating the wheat crop under modern irrigation systems in desert areas and to clarify the impact of the capacity of the systems in those projects in achieving the financial feasibility of their establishment, using the economic evaluation criteria for the projects. The research included a study of 60 projects in Anbar Governorate for the 2020-2021 production season. It has been shown that projects that use several systems, despite their high investment costs, can recover the money invested in them within a relatively short period. The projects that use modern irrigation systems covering 60 donums were among the best projects that achieved technical efficiency in the productivity of the wheat crop, and the average net income reached the cash in the sample is about 1.3 billion dinars, while the average net income per donum in the research sample is about 189 thousand dinars. The sample was not able to achieve accounting profits, The research recommended the need to use electric power systems as an alternative to relying on electric power generators, as the average price of solar power systems in the Iraqi market is currently within reach.

Key word: Prices, revenue, economic efficiency, economic evaluation criteria.
***Part of Thesis of the 1st author.**

التقييم المالي لمشاريع انتاج القمح تحت انظمة الري المحوري في محافظة الانبار

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المستخلص

هدف البحث الى اجراء تقييم مالي لمشاريع زارعة محصول الحنطة تحت انظمة الري الحديثة في المناطق الصحراوية في محافظة الانبار ، وتوضيح اثر سعة المنظومات في تلك المشاريع في تحقيق الجدوى المالية من انشائها، باستخدام معايير التقييم الاقتصادي للمشاريع. ضم البحث دراسة 60 مشروع في محافظة الانبار للموسم الانتاجي 2020–2021. وقد تبين تميز المشاريع المستخدمة منظومتين او اكثر على الرغم من تكاليفها الاستثمارية العالية بقدراتها على استرداد الأموال المستثمرة فيها خلال مدة قصيرة نسبيا، وان مشاريع التي تستخدم منظومات ري حديثة تغطي 60 دونم كانت من افضل المشاريع على مستوى انتاجية الدونم الواحد وقد بلغ معدل صافي الدخل النقدي في العينة نحو 1.3 مليار دينار ، فيما بلغ معدل صافي الدخل للدونم الواحد في عينة البحث نحو 189 الف دينار، بينت النتائج ان ما يدفع المزارعين في الاستمرار في عملية الانتاج هو صافي الدخل النقدي وليس الربح المحاسبي، اذ تبين ان عدد من مشاريع العينة لم تستطيع تحقيق ارباح محاسبية، وقد اوصى البحث ضرورة التوجه الى استخدام منظومات الطاقة الكهربائية كبديل لاعتماد على مولدات الطاقة الكهربائية حيث ان معدل اسعار منظومات الطاقة الشمسية في الاسواق العراقية حاليا بالمتناول .

الكلمات المفتاحية: أسعار، العائد، الكفاءة الاقتصادية، معايير التقييم الاقتصادي.
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INTRODUCTION

Iraq and the Middle East generally suffer from drought-stricken climatic conditions and limited renewable water resources, and if the country does not take effective and influential steps at various levels, to rationalize the consumption of those resources, the water problem is expected to worsen as demand increases (25). Water is one of the key elements of the mystery of life, it is an important wealth for the lives of humans, animals and plants. So, water is one of the basic components of development in its various contemporary economic and social concepts. Water resources are at the forefront of the concerns of the countries of the world in general and developed in particular, as they are working to develop their water resources and increase the efficiency of their exploitation and maintain them from waste to meet the growing demand for them and for all water uses. Therefore, we should improve the use of water by adopting methods that ensure that they are protected from waste, loss and pollution, in order to ensure our need and the need of his future generations, so this study tries through an economic, financial and technical assessment of modern irrigation systems in Iraq to choose the appropriate indicators and criteria for them and their multiple objectives, which include national economic profitability on the one hand, and commercial profitability on the other, and then to clarify the ability of these projects to reach them in a balanced way to achieve the main goal of achieving the establishment in its ability to increase the efficiency of the use of desert land and groundwater and take advantage of its advantages to serve national economic development and advance forward in our country, as the importance of research comes in the fact that the agricultural sector is the largest sector of water consumption, which constitutes 85% of the total water resources. Therefore, the importance of the issue for Iraq in particular because it is the most affected by Turkey's water policy due to its need for about 73 billion m^3 of water annually to cultivate nearly 22 million donum of irrigated arable land, this study examine and analyze ways to achieve the most appropriate exploitation of groundwater in wheat agriculture in Iraq and increase the efficiency of water use. The focus is on producing more output with available water resources or using less water to produce the same levels of production as achieved (10, 11). One such technique is the introduction and adoption of modern irrigation techniques on a large scale to invest groundwater resources to provide irrigation water for crops to reduce risk and increase income through increased productivity and stability.

MATERIALS AND METHODS

The requirements of the research have been fulfilled from the data it needs based on a questionnaire for a sample that included 60 projects in the desert region of Anbar governorate that produce the wheat crop using center-pivot irrigation systems. The sample was divided into four categories according to the capacity of the irrigation used, as the first category included projects that use systems pivotal irrigation systems covering 60 donums, while the second category includes projects that use pivotal irrigation systems covering 80 donums, the third category includes projects that use systems covering 120 donums, and the fourth category only includes projects that operate two or more systems in the same project. To reach accurate and objective results, the criteria were calculated at the level of one donum and the level of the ton produced from the wheat crop

Theoretical framework

The level of the performance evaluation system reflects the maturity of society in facilitating its affairs and represents the tool by which we recognize the current reality in preparation for its development (19). Project evaluation is becoming increasingly important as the country tends to reduce the role of the public sector, the role of the private sector increases and it seeks to optimize the use of available resources by directing these resources to the best available uses or so-called rational use (6). Economic efficiency is defined as the use of sources of wealth in such a way that one of the two things can be achieved, the first being greater production at the same previous production costs, and the second being the previous production itself at lower production costs (8). It is also known as maximizing profit within the production unit using the elements of production ideally (12).

The process of studying the efficiency of performance in the economic project is closely linked to the evaluation process and the feasibility of the project, because the tagged objectives of the project, which are expected to be achieved in the near and long terms through economic activities, have been devised and determined based on the criteria and foundations adopted in the evaluation of projects (1). All of this makes the process of studying and evaluating farms comprehensive and integrated, so setting appropriate criteria for agricultural activities is one of the most important foundations in the process of assessing the efficiency of agricultural activity in these projects. The evaluation process takes place in all economic activities, whether agricultural, industrial or service activities, and there is no fundamental difference in the evaluation of these activities, but rather a difference in how appropriate criteria are chosen for each activity (15). The research adopted a set of economic criteria:

Period of recovery of capital criterion: the period required to recover the capital invested in the project (2) i.e. the time in which the revenues can pay the amounts invested on the farm, we can use the following formula for its account

$$Capital\ recovery\ period = \frac{Invested\ capital}{Annual\ profit} * 100$$

Simple rate of return criterion: This criterion is sometimes called the accounting rate of return because it depends on the forecast of what the results of profit and loss accounts will be in accounting restrictions, it is calculated using the following formula (3):

$$Simple\ rate\ of\ return = \frac{Annual\ profit}{Invested\ capital} * 100$$

Cost-benefit ratio criterion (discounted profitability criterion)

It is the result of dividing the current value of the project's cash flows by the current value of cash flows out of the project (18). It is desirable to follow one way of calculating this standard when we use it as a basis for evaluating projects in a country to reduce the chances of misleading choices in the order of projects. For trade-offs between alternatives, priority is given to those projects that achieve the highest rate in the economic assessment process, and this criterion can be mathematically expressed as follows:

$$\frac{B}{C} ratio = \frac{\sum_{t=1}^{n} \frac{\text{Bn}}{(1+r)^n}}{\sum_{t=1}^{n} \frac{\text{Cn}}{(1+r)^n}}$$

Where:

B/C ratio: Benefit-to-cost ratio.

Bn: Revenue inflows.

Cn: Costs outflows.

n: The economic age of the project.

r: Interest rate.

This equation represents the first criterion for assessing the economic feasibility scale and the general rule is the acceptance of projects whose present value on costs is divided by present value, the result is one and truer in the case of a single project, either if there are several projects, the project with the highest rate is the most economically feasible (4).

The net present value criterion

The current value is the discounted value of cash flow received in the future (20). Net present value (NPV) is one of the methods of calculating discounted cash flow (22) and the net present value is defined as a means of calculating the current value of cash flows entering and leaving a particular investment and taking into account the net present value considering the time value of the money (5). This concept overcomes the difficulty of attempting to adjust the costs and returns that appear during different stages of time by making all amounts equal, converting them into a common basis or common current value so that all financial costs are equal to future financial returns (17) by using a discount coefficient to deduct cash flows entering their current value, after which the current value of all cash flows entering is compared with cash outflows (24). This is expressed mathematically as follows

$$V = \frac{C_{f1}}{(1+r)^1} + \frac{C_{f2}}{(1+r)^2} + \frac{C_{f3}}{(1+r)^3} + \ldots + \frac{C_{fn}}{(1+r)^n}$$

Where:

V: Current value of inflow income

$C_{f1}, C_{f2} \ldots C_{fn}$: expected cash flow

r: interest rate

n: years

The cash flows and the discount rate are two main factors that enter into the process of calculating the net present value (7), and since the NPV criterion includes evaluating the present value of the cash flow represented by the expected dividend using a discount rate that takes into account the investment risks, as the value is compared obtained at the initial cost (22). In general, the investment project is accepted if it ($o < NPV$), and rejects if it ($o > NPV$) and the investment project covers its economic costs only if it ($o = NPV$). One disadvantage of using this is that if the funds invested vary from project to project, the comparison does not give a good result. Therefore, to overcome the weaknesses of this criterion, some adjustments have been made, instead of dealing with the total return achieved, the return achieved by the monetary unit invested, which is the common denominator of the capital invested in various projects, has been adopted and dealt with.

Internal Rate of Return (IRR)

The Internal Rate of Return (IRR) is the project's expected rate of investment, so it is defined as a discount rate that is equal to the current value of expected cash flows with investment expenses (23). IRR is therefore only the discount rate that makes the net present value equal to zero (8). The current net worth (NPV) and internal rate of return (IRR) criteria generally lead to the same acceptance or rejection decision concerning investment selection (22). However, there are instances where the application of these criteria leads to conflicting results. The reasons for this conflict are the different assumptions of the current net value (NPV) and the internal rate of return (IRR) on the rate at which cash flows are reinvested, as the two methods assume that such funds are invested at a different rates of return (17). The net present value implies that the rate at which cash flows can be reinvested is the required rate of return, while the internal rate of return indicates that the investor has an opportunity to invest at the same internal rate of return on investment (24). The internal rate of return is defined as the discount rate that NPV zero. It is also defined as a discount rate that equates the current value of cash flows during the life of the investment with the initial investment value. The IRR for an investment (assuming the initial investment value of I in year 0) can be calculated through a zero (NPV) equality and as follows (8):

$$\text{NPV} = \sum_{t=1}^{n} f_t(1 + \text{r*})^{-t} - I = 0$$

The r* value must then be found that meets (NPV=O), as r* will represent the internal return rate IRR for the proposed investment. This rate will represent the profitability of the capital invested in the project throughout its productive life, i.e. for the duration of its stay. To extract the internal rate of return, we use the following equation (8):

$$IRR = LDR + \frac{PVLD}{PVLD + PVHD} * Dif$$

Where:

LDR: Lowest discount rate

PVLD: Present value at the lowest discount rate

PVHD: Present value at the higher discount rate

Dif: The difference between the two discount rates

RESULTS AND DISCUSSION

Costs of Investment

Investment costs are the requirements in the construction and implementation phase of the project, including the construction of steel structures, construction, machinery, equipment for the operation of the project and other requirements. By analyzing the costs of investment of assets for the research sample, the costs of pivot irrigation systems rank first in terms of their contribution to investment costs, accounting for 39% of the costs of investment assets, while items machinery and agricultural machinery accounted for about 20%, so reducing the costs of modern irrigation systems is an important factor in reducing the costs of investing in strategic crop projects under modern irrigation systems and would increase the area of arable land for these projects, This contributes to increasing the production of these agricultural crops to achieve food security and legalize the use of water, as well as to replace agricultural land with other crops that cannot be grown in desert areas, and the average share of donum investment costs is about one million dinars, which could be the upper limit for the reclamation and cultivation of desert land or the cost of adding one donum to the agricultural area studied and taking into

account the life span in irrigation projects. The 15-year-old projected annual cost of reclamation of one donum will be about 65,000 dinars, which begs the question of whether it is economically feasible to invest in the reclamation of desert lands in the shadow of the availability of agricultural land suitable for cultivation and not cultivated in Iraq, and the answer to this question is useless since the decision to invest and its purpose is to achieve financial profit, but environmental, social and national feasibility, since the aim of the investment is to cultivate desert areas to improve environmental conditions in the city and reduce the effects of dust storms and desert crawling into agricultural areas, also contribute to the legalization of the use of irrigation water, contribute to raising the rate of settlement in desert areas and create new jobs, and also contribute to reverse migration refer to table 1.

Table 1. Investment cost items in sample projects

Item	The cost			Importance (%)	No.
	Total (dinars)	At farm level (dinar)	At donum level (dinar)		
Buildings and facilities	843,000,000	21,075,000	116,921	12	40
irrigation system	2,777,250,000	35,605,769	385,194	39	78
Electric power generator	875,060,000	12,868,529	121,368	12	68
Artesian wells	418,020,000	5,648,919	57,978	6	74
Water pumps	251,470,000	3,592,429	34,878	4	70
Combine harvesters	657,000,000	65,700,000	91,123	9	10
Tractor	545,000,000	18,793,103	75,589	8	29
Pesticide sprinkler	62,535,000	3,126,750	8,673	1	20
Load cars	701,000,000	15,931,818	97,226	10	44
Total	7,130,335,000	182,342,318	988,951	100	433

Source: Prepared by the authors in light of the questionnaire.

Fixed costs: The costs in agriculture differ from the costs in other economic projects, as the bulk of the costs in agriculture does not change with the change in production and this part is called fixed costs and is estimated at 70% of the costs, while in most industries the variable costs constitute the bulk of them, and therefore it is easy to make some changes to production, and the other costs that change with the change in production are the variable costs (11). By analyzing the structure of the fixed costs of the research sample, the annual depreciation premium represents the highest contribution rate, as its contribution rate reached 72% of the total fixed costs in the research sample, although they are not considered real costs borne by the product, and from this point of view we see the fact that these costs are excluded when using some financial evaluation criteria, it contributes to correcting the investment decision, as the nature of the studied projects and the nature of wheat crop cultivation does not require fixed costs, but they must be calculated to compare between two different production patterns (9, 16) . and the investment requirements that would enable the farmer to grow the crop in the desert areas. The total fixed costs in the research sample amounted to about 1.07 billion dinars, an average of 17 million dinars at the farm level, and about 253 thousand dinars is the share of the cultivated acre of the total fixed costs refer to table 2.

Table 2. Fixed cost items for projects of sample

Item	Total (dinar)	The average for the farm (dinar)	The average for the donum (dinar)	Importance (%)
Rent the land	7,325,750	122,096	1,016.05	1
Annual depreciation	770,789,850	12,846,498	106,905.67	72
wages	297,570,000	4,959,500	41,271.84	28
Total	1,075,685,600	17,928,093	149,194	100

Source: Prepared by the authors in light of the questionnaire

Operation costs

It means the costs of productive elements that change with production change and will not exist if production does not occur and include the cost of fertilizers, seeds, fuel and pesticides. In the light of the analysis of operational costs in the research sample, the costs of agricultural operations and fertilizer and fuel costs accounted for about 67% of the total operation costs. Since agricultural

processes cannot be dispensed with and cannot be replaced in the production conditions of the wheat crop, so it is worth finding alternatives to reduce fuel costs and fertilizer costs (14), through reliance on solar systems and supporting and providing fertilizer to farmers, which will reduce the costs of growing the crop under modern irrigation systems, the total operation costs in the research sample amounted to 1.7 billion dinars, while the operation cost of one donum planted with wheat crop under modern irrigation systems amounted to about 240 thousand dinars refer to table 3.

Table 3. Operation cost items in the sample

Items	Total cost (dinar)	Cost for the farm (dinar)	Cost for the donum (dinar)	Importance (%)
Seed	226,930,000	3,782,167	31,474.34	13
Urea Fertilizer	127,272,000	2,121,200	17,652.15	7
DAP Fertilizer	254,041,000	4,234,017	35,234.54	15
Leaf fertilizer	26,037,850	433,964	3,611.35	1.5
Pesticides	116,822,400	1,947,040	16,202.83	7
Fuels	357,294,100	5,954,902	49,555.35	21
maintenance	115,280,000	1,921,333	15,988.90	7
Agricultural operations	400,744,382	6,679,073	55,581.75	23.1
Marketing operations	108,422,400	1,807,040	15,037.78	6
Total	1,732,844,132	28,880,736	240,339	100

Source: Prepared by the authors in light of the questionnaire.

Table 4. Investment and total costs according to the sample categories

Category	No. of projects	Investment	Operational	Fixed costs	Total costs
first	17	1312810000	301,081,100	195,270,950	496,352,050
second	23	2520625000	578,345,600	392,620,750	970,966,350
third	9	972460000	272,788,999	155,903,400	428,692,399
fourth	11	2324440000	580,628,433	331,890,500	912,518,933
Total	60	7130335000	1,732,844,132	1,075,685,600	2,808,529,732

Source: Prepared by the authors in light of the questionnaire.

Revenue analysis of projects of the sample

The cultivated areas amounted to about 7210 dunams, distributed among the sample categories. The total revenue in the research sample amounted to about 3 billion dinars, and the revenue per donum was about 427 thousand dinars, while the productivity in the research sample was 0.795 tons / donum. The first and second categories recorded the highest rate of productivity per donum amounting to about 0.99 and 0.97 tons respectively, which is evidence of the technical efficiency that these projects have despite the small irrigation system capacities. Large systems in the third category have the lowest productivity rate per dunam, as it reached about 0.588 tons / donum, which was reflected in the decrease in revenue per acre, which amounted to about 325 thousand dinars, which is less than the average by 24% refer to table 5.

Table 5. Production quantities and revenues

Category	Area donum	Production ton	Productivity (dinar/donum)	Revenue (Dinar)	Revenue of dinar/donum
first	1020	992	0.973	548750000	537990.1961
second	1840	1795	0.976	1009490000	548635.8696
third	1290	759	0.588	419790000	325418.6047
fourth	3060	1970	0.644	1110290000	362839.8693
Total	7210	5516	0.795	3088320000	1713353.675

Source: Prepared by the authors in light of the questionnaire.

Results of financial evaluation criteria

The success of the evaluation process depends on the selection of appropriate indicators and standards that fit the nature of the project to be evaluated, as each project has a specific specificity that distinguishes it from the rest of the other projects, and must choose and use the criteria that are accurate, objective and integrated among them to achieve the goal of conducting this evaluation. After studying the investment costs and fixed and variable costs in the research sample and as previously

analyzed revenues in the previous research, it became possible to use the evaluation criteria the average net cash income for the projects studied was about 1.3 billion dinars, while the average net income per donum in the research sample was about 189,000 dinars, with net cash income per farm reaching about 22 million dinars, but there is a disparity in net income achieved in the research sample farms, to reach a more accurate financial analysis. For the sample projects studied, the sample was divided into four categories based on the type of capacity of the system used and the area under cultivation, when it was found that the first category, which included projects using pivot irrigation systems exceeding 60 donum achieved the best productivity at the sample level of about 0.973 tons/ donum, which is 22% higher than the average sample, and this applies to category II projects that included irrigation systems covering 80 dunams, we conclude that irrigation systems are 600 tons larger and 80 donum are more efficient in the use of these systems in achieving the best possible productivity and perhaps the role of the system management factor and its ease of use as well as the less experience of farmers made them more efficient in the use of small systems at the technical level, while the third category, which included projects used for irrigation systems with a capacity of 120 donums, recorded the lowest level of productivity of about 0.588 tons of donum, which is the lowest average sample by 25%, and may have had the least negative causes. On the technical efficiency of this volume of capacity in light of the low experience and knowledge factor of farmers in the research sample has contributed with factors of nature such as the nature and type of soil and crop service processes, while the fourth category saw the highest net cash return per ton of wheat crop despite the decline in the productivity of donum at about 0.644 tons / donum, as farmers in this category benefited from the multiplicity of irrigation systems in their projects, including projects in this category, which included projects that included It has many modern irrigation systems, and the factor of accumulation of experience and knowledge of this technology is the only one that drives farmers to install and operate several modern irrigation systems and most farmers in this sample own irrigation systems with capacities of 60 donum and 80 donum s, and it is natural that this category achieves the highest value of the net income standard of about 526 million dinars, followed by the second category, which is not an indication of the feasibility of these projects due to the increase in the size of the area cultivated, but the net return at the donum level is proof of the feasibility of the project as it gives more accurate results and contributes to the trade-off between projects regardless of the cultivated areas. Farms with capacities of 120 donum have recorded the lowest standard rate per donum of about 112. While the one donum in the research sample achieved an accounting profit of 38,000 dinars while the total in the research sample was about 279 million dinars at a rate of about 4.6 million dinars per farm, what drives farmers to continue the production process is net cash income and not accounting profit, as farmers usually care about cash costs and neglect the implicit costs, mainly the annual extinction premium or the costs of alternative opportunities for the effort sought in managing the process. Productivity, in the absence of income tax, farmers in the management of farmers do not need accounting records that restrict this type of cost and only calculate its sales and purchases of raw materials used in the production process, as a number of sample projects may be able to achieve accounting profits as it was found that about 24 projects have suffered losses, and in order to give this standard better images by analyzing projects according to the capacities of the pivot irrigation systems, it turns out that the third category containing on irrigation systems with capacities of 120 donum has achieved losses in the language of about 8 million dinars, an average of about 926 thousand dinars per farm, while the share of the donum of these losses amounted to about 6,000 dinars and farmers in this category are exposed to losses of 11 thousand dinars per ton produced in their farms, while the fourth category, which included farms that own several pivot irrigation systems, achieved the highest amount of accounting profit amounted to about 100 thousand Dinars per ton produced and

about 64,000 at the level of donum, which is 67% higher than the average profitability of the donum in the research sample, followed by the second category with an accounting profit at the level of donum reached 32% higher than the average sample refer to table 6.

Table 6. Net income and accounting profit results in sample categories (dinar)

Category	Net income for the sample	Net return per donum	Sample accounting profit	Accounting profit for donum
First	246,952,750	242,111	52,397,950	51,371
Second	428,882,400	233,088	38,523,650	20,937
Third	145,572,801	112,847	-8,902,399	-6,901
Fourth	526,742,167	172,138	197,771,067	64,631
Average	337,037,530	186,983.37	69,947,567	38,806
Total	1,348,150,118		279,790,268	

Source: Prepared by the authors in light of the questionnaire.

The accounting return on sample farms was about 3.3%, which is higher than the 3% return on savings in government banks, but this return is not enough to bear producers for productive and marketing risks, as wheat crop farmers often complain about high production costs and lower returns, especially since this production pattern of wheat crop requires significant investment costs compared to their peers in the regions and other production patterns that do not require significant investment costs, and has achieved projects category four is the highest accounting return rate of about 8.5%, which is an indication of the feasibility of projects in this category, which owns several modern irrigation systems in the same project, despite their high investment costs and low productivity of one donum, this farmer was able to achieve a rewarding return that exceeds the prevailing interest rates in the markets, while the second category achieved the lowest positive accounting return rate of about 1.5%, while the value of the standard in the farms of the first category was about 4%. The third category farms could not achieve a positive accounting rate of return due to the losses suffered by some of the category projects, which were found to be related to low productivity on the one hand and the high costs of one donum on the other hand, which negatively affected the profits of those projects. The criterion of the return on the invested dinar, which is a good indicator of the economic project data, shows the annual revenue that the monetary unit generates for the total annual costs. If compared to the returns on investment in the cultivation of other crops, the lowest value of this criterion was recorded in the third category that uses irrigation systems with capacities of 120 donums, as the value of the criterion was about 0.979, meaning that these projects lose about 21 fils for every dinar invested in these projects, while The fourth category achieved the highest value of the invested dinar return criterion, which amounted to about 1.217 dinars, i.e. these projects generate a net return of 217 fils for each dinar invested in the production process of these projects, which is 12% higher than the sample average, which is consistent with the results of the accounting return criterion in feasibility. Investing in such projects, as the results of this variable capital productivity criterion showed the efficiency of all projects in the research sample in the use of production requirements, as the productivity of variable capital in the sample farms amounted to 1.755 per invested dinar. This means that it achieved a return of 755 fils. The fourth and first categories recorded the highest rate of productivity in the use of productive resources, which amounted to about 1,912 and 1,823, respectively. The third category achieved a net return of 539 fils for each investor dinar. The results of this criterion showed the efficiency of the project sample in the use of productive resources and achieving rewarding returns, and this is inconsistent with the results of some of the criteria used. We conclude from the above that relying on several criteria in the evaluation process gives a more truthful and accurate picture and shows the economic feasibility of projects objectively, as the costs are the alternative opportunities and the costs of the premium of extinction. The annual is one of the determinants of the feasibility of the sample projects, in light of the low profits and returns of the one donum planted with the wheat crop. The payback period of the money invested in the sample projects was about 7.7 years, meaning that the sample farms need

seven years and eight months to recover the money invested in them, and since the life span of the pivot irrigation systems is estimated at fifteen years, it can be said that the recovery period of the invested money is large and that it needs half its productive life or a little more than for the project to recover its money and achieve profits in the remaining half of its life. The lowest recovery period was recorded in the fourth category, as it reached about five years, which is a good period compared to the high investment costs in that category, while the highest recovery category was recorded in the third category in the language of about 10 years and ten months. Although the projects of this category were exposed to losses according to the results of the accounting profit criterion, the annual depreciation premium costs exceeded those losses and contributed to the recovery of the capital invested in those projects.

Table 7. Results of traditional discounted financial assessment criteria

Category	Simple rate of return	Return on the invested dinar	Recovery period	Variable capital productivity
First	4.0%	1.106	7.126	1.823
Second	1.5%	1.040	7.853	1.745
Third	-0.9%	0.979	10.930	1.539
Fourth	8.5%	1.217	5.093	1.912
Average	3.3%	1.085	7.750	1.755

Source: Prepared by the Authors in light of the questionnaire.

The results of the discounted criteria amounted to the ratio of current benefits to current costs deducted in the study sample projects 1.038, as shown in Table 7 a good indicator of the poor acceptance of investment in these projects, and means that the farmer is expected to achieve a net income of 0.038 dinars per dinar spent in it, which is low income to judge the profitability of the financial project, although it is greater than one. The ratio of current benefits to current costs in first category projects was 1.22, as farms are expected to generate a net income of 0.022 dinars per spent dinar, while in category II and III farms this percentage has fallen to 0.990 and 0.915 respectively, an indication of the futility of investing in these projects with capacity irrigation systems 80 donums and 120 donums, as they achieve losses of 0.009 and 0.085 dinars per dinar invested respectively. The ratio of benefits to costs deducted in fourth category projects has increased to 1,157, i.e. these projects achieve a net return of 0.157 dinars per invested dinar despite the high investment costs, which we have already concluded in the light of the results of the discounted profitability guide criterion that investing in the operation of 60 donum of pivot irrigation systems or operating some pivot irrigation systems in the same project is a prerequisite for achieving the economic feasibility of the investment process. In table 8, the net current value using a 10% discount factor in the study sample projects is about 860 million dinars, a positive value indicating the economic feasibility of growing wheat crops using pivot irrigation systems and showing its ability to achieve financial profits during its productive life, but when compared to the level of the capacities of irrigation systems in the research sample, it was found that the fourth category is the most economically feasible category among the sample groups followed by the projects of the first category with the capacities of the system Irrigation covers 60 donums, and since these projects compete for the same resources of land and capital, we believe that farmers will be encouraged to invest in increasing the number of systems with capacities of 60 donums with untapped holdings in the research sample amounting to about 10,000 donums, which will improve the profitability and feasibility of existing projects, while category II and III projects have not been able to achieve net positive present value as the value of the standard has recorded a negative value, which is negative. An indication of the futility of the projects of that sample. The results of the calculation of the internal return criterion for sample farms, which amounted to 12.1%, which deducts net cash flows of farms to make them equal to zero, which reflects the marginal adequacy of the capital invested in sample projects, which is greater than the prevailing interest rates in the markets, indicates the feasibility of investing in wheat crop cultivation projects under pivotal irrigation

systems despite the low value of the accounting profit criterion. Fourth category farms achieved the highest internal rate of return of 18%, followed by first category farms with an internal rate of return of about 11%. The second and third category farms had a rate of return of 9% and 4%, respectively, the lowest discount rate recorded in the research sample categories and evidence of the futility of investing in production capacities of 80 donum and 120 donum according to the results of this criteria. It can be said in the light of the results that investing in wheat crop cultivation under modern irrigation systems is economically viable, as it achieved an internal rate of return that exceeds the discount rate used to deduct cash flows, which reflects the costs of alternative opportunities to invest in other projects at the sample level, while the category of large farms that own two or more systems outperformed the rest of the farms in achieving the highest internal rate of return in light of the efficiency of the use of investment assets in achieving profits and over the life of the project. After reviewing the evaluation criteria, the most important observation we would like to point out is that no matter how accurate the evaluation results may be, they are not in themselves a necessary and sufficient condition for the success of the project and the expected results, as poor implementation or management may fail all the underlying positives. Practical experience has often shown that good implementation and management of investment projects with modest economic or financial returns are often more feasible than poor implementation and management of investment projects with significant economic returns.

Table 8. Results of discounted economic assessment criteria (dinar)

Category	Discounted internal flow	Discounted outflow	Net present value	Benefit-to-deductible ratio	Internal rate of return (%)
First	**4,173,836,129**	**4,085,357,185**	**88,478,944**	**1.022**	**11.20**
Second	**7,678,261,201**	**7,757,468,546**	**(79,207,345)**	**0.99**	**9.40**
Third	**3,192,956,116**	**3,488,681,915**	**(295,725,799)**	**0.915**	**4.20**
Fourth	**8,444,954,015**	**7,298,038,909**	**1,146,915,106**	**1.157**	**18.00**
Total sample	**23,490,007,461**	**22,629,546,555**	**860,460,906**	**1.038**	**12.10**

Source: Prepared by the authors in light of tables (2 -7).

When reviewing the results of the evaluation criteria in the conditions of risk and uncertainty, it was found that the volume of production in the sample farms reached 4,377 tons representing the lowest amount of production with total revenue equal to total costs, while the percentage of production safety margin was about 21%, and the revenue achieved at the break-even point was about 2.4 billion dinars, which is the minimum revenue that achieves economic profit, while the equivalent rate was 79%, which is the ratio of production capacity, which is the ratio of production capacity, which is the percentage of production capacity. Sample farms work for this profit. The maximum production volume at the break-even point in the third category farms, which reached 805 tons to be the percentage of the margin of productive safety in this category 106% and is of negative value, i.e. these projects are reserved to reach the break-even point as they need to increase their production by 6% to reach the break-even point as they have to produce 46 tons using the same resources available to reach the point of economic profit due to the decrease in the yield of the donum in this category. In light of the low safety margin in wheat crop cultivation projects in general, as on the sample farms, while the percentage of safety margin in fourth category farms increased to about 37%, the highest safety margin recorded in the research sample categories, and it was found that the farms of the category enjoy a low production risk, using 63% of their production capacity to achieve production at the break-even point of 1234 tons, which does not mean that these projects in the category have a efficiency in the use of resources as the margin of safety may not be sufficient for fluctuations that can be exposed to environmental and other factors that significantly affect the productivity of donum due to the depletion of soil nature, water availability and many other factors to which the agricultural sector is exposed, while the number of farms in the first and second category was 782 and 1635 tons respectively, while the production safety limit for them was 21% and 9% for the two categories

respectively, The value of production at the break-even point was 423 million dinars for the first category, and about 919 million dinars for the second category, which is the revenue to be achieved in the farms of the two categories to cover the total costs.

Table 9. Production quantities at the break-even point

Category	Amount of production at the break-even point (ton)	Revenue at the break-even point (dinar)	Tie rate (%)	Security margin	Production security limit ratio (%)
First	782	432,653,974	79	210	21
Second	1,635	919,289,966	91	160	9
Third	805	445,212,534	106	-46	-6
Fourth	1,234	695,717,278	63	736	37
Total sample	4,377	2,450,845,073	79	1,139	21%

Source: Prepared by the Authors in light of the questionnaire.

In the light of the results obtained from the study, we conclude that the pivotal irrigation system in the studied areas constitutes the greatest value as more than one-third of the investment costs due to it and the product is borne by the purchase of the system, and that reducing the costs of modern irrigation systems is an important factor in reducing the costs of investing in strategic crop projects under modern irrigation systems and would increase the area of arable land for these projects, which contributes to increas the production of these crops. To achieve food security and rationing the use of water, as well as to replace agricultural land with other crops that cannot be grown in desert areas. The average share of donum of investment costs was about one million dinars, which could be the upper limit for the reclamation and cultivation of desert land or the cost of adding one donum to the agricultural area in the studied area, and taking into account the life span in the pivotal irrigation projects estimated at 15 years will be the annual cost of reclamation of one donum about 65 thousand dinars, which raises the question of whether it is economically feasible to invest in the reclamation of desert land in the shadow of The research also concluded that the investment aims to cultivate desert areas to improve environmental conditions in the city and reduce the effects of dust storms and desert crawling into agricultural areas, also contributes to the rationalization of irrigation water use, contributes to raising the rate of settlement in desert areas and creates new jobs, and also contributes to reverse migration.

The cultivated land under center pivot irrigation systems constitutes only 79% of the total area in the best case. The percentage of waste in the farm area depends on the nature of the land, the number of systems and their distribution within the agricultural land. The research concluded that the capacity of the center pivot irrigation systems 60 and 80 donums is the most technically feasible compared to other capacities and that the use of several systems of these capacities in one farm contributes to achieving the economic feasibility of investing in wheat crop production projects under modern irrigation systems in the regions. And in light of the conditions of risk and uncertainty, wheat cultivation projects under pivotal irrigation systems are among the projects with high production and marketing risks, as the parity ratio reached 79%, which is the proportion of the production capacity to achieve profit.

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